Standard Test Method for 
Effect of Water on Compressive Strength of Compacted 
Bituminous Mixtures

1 This test method is under the jurisdiction of ASTM Committee D04 on Road 
and Paving Materials and is the direct responsibility of Subcommittee D04.22 on 
Effect of Water and Other Elements on Bituminous Coated Aggregates. 
2 For referenced ASTM standards, visit the ASTM website, www.astm.org, or 
contact ASTM Customer Service at service@astm.org. For Annual Book of ASTM 
Standards volume information, refer to the standard’s Document Summary page on 
the ASTM website.

1. Scope

1.1 This test method covers measurement of the loss of 
compressive strength resulting from the action of water on 
compacted bituminous mixtures containing asphalt cement. A 
numerical index of reduced compressive strength is obtained 
by comparing the compressive strength of freshly molded and 
cured specimens with the compressive strength of duplicate 
specimens that have been immersed in water under prescribed 
conditions.

1.2 This standard does not purport to address all of the 
safety concerns, if any, associated with its use. It is the 
responsibility of the user of this standard to establish appro-
priate safety and health practices and determine the applica-
bility of regulatory limitations prior to use.

2. Referenced Documents

2.1 ASTM Standards:

C 670 Practice for Preparing Precision and Bias Statements 
for Test Methods for Construction Materials
D 1074 Test Method for Compressive Strength of Bitumi-
 nous Mixtures
D 2726 Test Method for Bulk Specific Gravity and Density 
of Non-Absorptive Compacted Bituminous Mixtures
D 6752 Test Method for Bulk Specific Gravity and Density 
of Compacted Bituminous Mixtures Using Automatic 
Vacuum Sealing Method

3. Significance and Use

3.1 This test method is useful as an indicator of the 
susceptibility to moisture of compacted bitumen-aggregate 
mixtures.

4. Apparatus

4.1 One or more automatically controlled water baths shall 
be provided for immersing the specimens. The baths shall be of 
sufficient size to permit total immersion of the test specimens. 
They shall be so designed and equipped as to permit accurate 
and uniform control of the immersion temperature within 
± 1°C (1.8°F). They shall be constructed of or lined with 
copper, stainless steel, or other nonreactive material. The water 
used for the wet storage of the specimens shall be either 
distilled or otherwise treated to eliminate electrolytes and the 
bath shall be emptied, cleaned, and refilled with fresh water for 
each series of tests.

4.2 A manually or automatically controlled water bath also 
shall be provided for bringing the immersed specimens to the 
temperature of 25 ± 1°C (77 ± 1.8°F) for the compression 
test. Any convenient pan or tank may be used provided it is of 
sufficient size to permit total immersion of the specimens.

4.3 A balance and a water bath with suitable accessory 
equipment will be required for weighing the test specimens in 
air and in water in order to determine their densities, the 
amount of absorption, and any changes in specimen volume 
resulting from the immersion test.

4.4 A supply of flat transfer plates of glass or other 
non-reactive material will be required. One of these plates shall 
be kept under each of the specimens during the immersion 
period and during subsequent handling, except when weighing 
and testing, in order to prevent breakage or distortion of the 
specimens.

5. Test Specimens

5.1 At least six 101.6 by 101.6-mm (4 by 4-in.) cylindrical 
specimens shall be made for each test. The procedures de-
scribed in Test Method D 1074 shall be followed in preparing 
the loose mixtures and in molding and curing the test speci-
mens.

NOTE 1—This test method was developed to measure the loss of 
compressive strength due to water for specimens designed at approxi-
mately 6 % air voids by the compaction procedures of Test Method 
D 1074. When used with mixtures designed by other test methods, it is 
possible that the specimens will be compacted to some other void level
which may influence the results. Some agencies have established an air void or percent density target to which the specimens should be compacted. This is accomplished by adjusting the loading in the Molding and Curing Test Specimens Section of Test Method D 1074.

6. Determination of Bulk Specific Gravity of Test Specimens

6.1 Allow each set of six test specimens to cool for at least 2 h after removal from the curing oven described in Test Method D 1074. Determine the bulk specific gravity of each specimen in accordance with the procedure (thoroughly dry specimens) and calculation (bulk specific gravity) sections of Test Method D 2726 or Test Method D 6752.

**NOTE 2**—The calculation of air voids may be dependent on the test method used to determine the bulk specific gravity of the compacted sample.

7. Procedure

7.1 Sort each set of six test specimens into two groups of three specimens each so that the average bulk specific gravity of the specimens in Group 1 is essentially the same as for Group 2. Test the specimens in Group 1 as described in 7.1.1. Test the specimens in Group 2 as described in 7.1.2 unless the alternative procedure described in 7.1.3 is specified.

7.1.1 *Group 1*—Bring the test specimens to the test temperature 25 ± 1°C (77 ± 1.8°F), by storing them in an air bath maintained at the test temperature for not less than 4 h and determine their compressive strengths in accordance with Test Method D 1074.

7.1.2 *Group 2*—Immerse the test specimens in water for 24 h at 60 ± 1°C (140 ± 1.8°F). Transfer them to the second water bath maintained at 25 ± 1°C (77 ± 1.8°F) and store them there for 2 h. Determine the compressive strength of the specimens in accordance with Test Method D 1074.

7.1.3 *Group 2, Alternative Procedure*—Immerse the test specimens in water for four days at 49 ± 1°C (120.2 ± 1.8°F). Transfer them to the second water bath maintained at 25 ± 1°C (77 ± 1.8°F) and store them there for 2 h. Determine the compressive strength of the specimens in accordance with Test Method D 1074.

7.1.1.1 Allow each set of six test specimens to cool for at least 2 h after removal from the curing oven described in Test Method D 1074. Determine the bulk specific gravity of each specimen in accordance with the procedure (thoroughly dry specimens) and calculation (bulk specific gravity) sections of Test Method D 2726 or Test Method D 6752.

8. Calculation

8.1 Calculate the numerical index of resistance of bituminous mixtures to the detrimental effect of water as the percentage of the original strength that is retained after the immersion period as follows:

$$\text{Index of retained strength, } \% = \left( \frac{S_2}{S_1} \right) \times 100$$

where:

- \(S_1\) = compressive strength of dry specimens (Group 1),
- \(S_2\) = compressive strength of immersed specimens (Group 2).

9. Precision and Bias

9.1 *Single-Operator Precision*—The single-operator standard deviation has been found to be 6 % (see Note 3). Therefore, results of two properly conducted tests by the same operator on the same material should not differ by more than 18 % (see Note 3).

**NOTE 3**—These numbers represent, respectively, the (1s) and (d2s) limits as described in ASTM Practice C 670.

9.2 *Multilaboratory Precision*—The multilaboratory standard deviation has been found to be 18 % (see Note 3). Therefore, results of two properly conducted tests from two different laboratories on identical samples of the same material should not differ by more than 50 % (see Note 3).

10. Keywords

10.1 bituminous paving mixtures; compression testing; moisture; water